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NATIONAL ENERGY BOARD

Report In The Matter of a Public Inquiry
Into an Accident on the Pipeline System
of Sun Pipe Line Company Near the
St. Clair River Crossing
in October 1986 Near Sarnia, Ontario

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National Energy Board

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF a Public Inquiry into the Sun Pipe Line Company accident near St. Clair River crossing, Sarnia, Ontario.

HEARD at Sarnia, Ontario on: 10, 11 and 12 February 1987

BEFORE:

R.B. Horner, Q.C.
R.F. Brooks
A.B. Gilmour

Presiding Member
Member
Member

APPEARANCES:

M.M. Peterson
J.L. Finnigan

Sun-Canadian Pipe Line
Company Limited

D.H. Rogers, Q.C.

Sun Pipe Line Company

B.H. Morrison

Dixxin Construction Ltd. and
Domenic Iacovella

K. McGuire
D. Stoesser

Capex Contractors/ Anthony Iacovella
Mar-D Construction and Mario DiCocco

S. Kangarloo

Shell Canada Limited

B. Easton
H. Papps

Union Gas Limited

S. Anusiewicz

Dow Chemical Inc.

B.J. Sullivan

Kel-Gor Limited

L. Meagher

National Energy Board

Abbreviations

Bell	Bell Canada
Capex	Capex Contractors
cm	Centimetre
Dixxin	Dixxin Construction Limited
EDT	Eastern Daylight Savings Time
HVP	High vapour pressure
Kel-Gor	Kel-Gor Limited
km	Kilometre
kPa	Kilopascals
LVP	Low vapour pressure
Mar-D	Mar-D Contractors
m³	Cubic metres
m	Metres
mm	Millimetres
NEB or the Board	National Energy Board
O.D.	Outside diameter
psi	Pounds per square inch
Sun	Sun Pipe Line Company
Sun-Canadian	Sun-Canadian Pipe Line Company Limited
Union Gas	Union Gas Limited
U.S.	United States of America



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Abstract

On 27 October 1986, at 1001 hours EDT, a Sun Pipe Line Company 219 mm (8-inch) O.D. pipeline, carrying butane, an HVP product, at a pressure of approximately 4 135 kPa (600 psi), was accidentally damaged near a street running along the Canadian side of the St. Clair River near Sarnia, Ontario. The accident occurred near a manually-operated valve at the east end of the pipeline river crossing. The existing valve was to be replaced by a new one with a motor-operated mechanism. As part of the job, a backhoe was in the process of removing earth to expose the pipe. The backhoe hit a fitting projecting above the pipe, tearing it from the pipe wall which resulted in the release of butane. A cloud of butane vapour enveloped the work site and several nearby houses and vehicles and extended westward onto the St. Clair River. After about three minutes, the vapour ignited. The resulting fire severely burned one person and injured three others. Some property damage also occurred.

The fire was contained at the site by local firefighting crews and persons were evacuated from the immediate area by police. Escaping butane from the line burned on site until 29 October 1986 when the remaining line contents were displaced with water and the site secured.

The Board conducted investigations into the circumstances of the accident both at the scene, from 27 to 29 October 1986, and in a public inquiry, held pursuant to Hearing Order MH-2-86 from 10 to 12 February 1987 in Sarnia, Ontario.

This report sets out the results of the Board's investigations together with its findings and recommendations.

Synopsis

On 27 October 1986 at 1001 hours EDT, the Sun pipeline, which runs from the Sun-Canadian pump station in Sarnia to Toledo, Ohio, was damaged near the mainline block valve on the Canadian side of the St. Clair River.

The line is owned by Sun Pipe Line Company but the 3.5 km section from the Sarnia pump station to the international boundary has been operated and maintained under contract since 1953 by Sun-Canadian Pipeline Company Limited.

The damage occurred when a backhoe hit a Hillco tapping nipple on the pipeline during the excavation for relocation of the mainline block valve. Kel-Gor Limited had a written contract with Sun-Canadian to perform the relocation work. The contract included the excavation and removal of approximately 30 m of pipe, the fabrication, testing and installation of new pipe, a motor-operated valve and insulating joints, and the supply and installation of a chain-link fence. A few days after being awarded the contract, Kel-Gor entered into a verbal contract with Dixxin Construction Limited for the excavation of the pipe.

Dixxin was notified by Kel-Gor a few days prior to 27 October 1986 that the excavation was to be started on 27 October 1986. Since Dixxin's backhoes and labourers would not be available on that date, Dixxin hired a backhoe from Capex Contractors, and a foreman, Mr. Mario DiCocco, an operator, Mr. Ronaldo DiCocco, and a labourer, Mr. Aldo Rocco, from Mar-D Contractors.

On 27 October 1986, just prior to beginning the excavation, Mr. Lee Schultz, the inspector for Sun-Canadian for the excavation work, determined the depth of the pipeline by looking down the valve stem cannister. He then directed Mr. M. DiCocco to have excavation begin with the backhoe near the valve cannister to a depth of one foot per cut, after which he would probe for the line.

After the first two cuts, Mr. Schultz struck something hard with the probing bar. Hand-digging revealed an insulating flange box. At this point, the evidence differs.

Mr. Schultz stated that the backhoe was moved further east after the exposure of the insulating flange box and hand excavation at that location uncovered a Hillco tapping nipple. He testified that no other fitting was uncovered. Messrs. Mario and Ronaldo DiCocco and Mr. Rocco stated that the hand excavation of the flange box also uncovered a coupling welded cap. The backhoe was then moved further east to continue excavation. According to their testimony, the Hillco tapping nipple was never uncovered. It is clear, however, that at 1001 hours EDT, the bucket of the backhoe hit the Hillco fitting at a point 18.2 cm above the body of the pipe causing a release of butane the force of which threw Mr. Rocco and Mr. M. DiCocco from the excavation. A butane vapour cloud formed immediately and enveloped

the work site and several nearby houses and vehicles and extended westward onto the St. Clair River.

Messrs. Rocco and M. DiCocco made their way through the vapour cloud to the St. Clair Parkway where they were picked up by a passing motorist and taken to the Shell Emergency Unit approximately 600 m south of the accident site. Mr. R. DiCocco shut off his backhoe and made his way to the road where he, too, was picked up by a motorist and taken to the Shell Emergency Unit. Mr. Schultz was in the process of evacuating the nearby residences when he was burned in the accidental ignition of the butane cloud which occurred approximately three minutes after its release. He was driven to Sarnia General Hospital by a passing motorist.

The fire was contained at the site on 27 October 1986, by crews from the Shell and Suncor refineries, and the fire departments of Sarnia, Courtright and Corunna. Also, on 27 October 1986, the Ontario Provincial Police secured the area and evacuated nearby residents. Temporary repairs to the pipeline were completed on 29 October 1986. The pipeline was permanently repaired by 31 October 1986 by completing the valve relocation project. Service was restored at approximately 2400 hours EDT, 31 October 1986.

A more detailed description of the accident and related events is found in Appendix A.

Injuries

Mr. L. Schultz received 2nd and 3rd degree burns to his face, arms, chest and legs and was retained in hospital for 30 days.

Mr. R. DiCocco suffered from inhalation of vapours and was retained in hospital overnight.

Messrs. M. DiCocco and A. Rocco suffered minor injuries and were treated and released on 27 October 1986.

Property Damages

The following items were destroyed by the fire:

- one backhoe JSW Excavator;
- three 1/2-ton pickup trucks;

- two private vehicles;
- one Bell Canada van; and
- one private garage.

In addition, two private residences suffered exterior damage and two hydro poles were damaged.

The Investigation

Since the Canadian portion of the Sun pipeline system is under the Board's jurisdiction, the Board carried out an investigation of the accident which culminated in a three-day public inquiry in Sarnia beginning 10 February 1987. Sun-Canadian personnel gave evidence on the circumstances surrounding the accident, the procedures for maintaining the portion of the Sun pipeline system operated by Sun-Canadian and those to be followed in case of an emergency, the scope of the valve relocation contract with Kel-Gor, the training and experience of Sun-Canadian's personnel involved with that contract, and the safety measures undertaken or considered by Sun-Canadian since the accident. Witnesses for Kel-Gor, Dixin, Capex, and Mar-D also presented evidence on their involvement with the valve relocation contract, the events on 27 October 1986, and their experience with the excavation of HVP pipelines. Mr. Tom Smith, the Bell employee who was locating the Bell utilities on the work site at the time of the accident, presented evidence which enabled the Board to determine the time of the release of butane and the approximate time of ignition of the resulting vapour cloud.

Findings

In the Board's view, the following facts may have contributed to the cause of the accident:

1. Although Sun-Canadian's maintenance manual has a requirement that any changes or additions to pipeline facilities, such as valves or Hillco nipples, be recorded on the master plan, the drawings provided to field personnel for the excavation of the existing pipe did not indicate the existence or location of either the coupling welded cap or the Hillco tapping nipple;
2. Information concerning the 1966 installation of the Hillco tapping nipple was on file with Sun-Canadian but had not gone through the proper

- channels for recording on Sun-Canadian's plans or files of the Sun pipeline system;
3. The use of powered excavating equipment, in this case a backhoe, in close proximity to the pipeline was contrary to the requirements of the Sun-Canadian Maintenance Manual. The manual stipulates that powered excavation equipment shall not be used within 30 cm of the pipeline;
 4. The main contractor, Kel-Gor, had subcontracted the excavation portion of the work and did not advise Sun-Canadian or request their consent as required by the contract. Sun-Canadian's on-site inspector was also unaware of this prohibition and allowed the subcontractor to proceed with the excavation;
 5. The sub-contractor, Dixxin, and the people who actually performed the excavation work were either not sufficiently informed of the characteristics and dangers of HVP products, in this case butane, and of the special safety measures to be taken when excavating such lines, or not sufficiently prepared, through their own practices and procedures, to safely perform excavations on HVP pipelines;
 6. Other on-site activities, such as the location of the Bell lines, were proceeding simultaneously with the excavation resulting in Mr. Schultz's attention being directed away from the pipe excavation activities immediately prior to the release of the butane. Sun-Canadian did not take steps to ensure that the other activities had been completed prior to the commencement of excavation so that the inspector's attention could be directed fully to the excavation of the pipeline; and
 7. Direct lines of responsibility for the activities on site were not established by either Sun-Canadian or the main contractor, Kel-Gor. Since a representative from Kel-Gor was not on site, the sub-contracting personnel assumed that the Sun-Canadian representative would be supervising the excavation and were prepared to take instructions from him. Mr. Schultz, however, arrived on site prepared only to act as Sun-Canadian's inspector.

The Board considers that the matter of which of two fittings, the coupling welded cap or the Hilco tapping nipple, was located prior to the accident

was not a material factor, since, in any event, a minimum clearance of 30 cm was not maintained between the powered excavating equipment and the pipeline. It is an undisputed fact that a fitting extending less than 30 cm above the pipeline was struck by the backhoe bucket during excavation.

The Board further finds that the following facts may have contributed to the property damages and personal injuries resulting from the accident or increased the potential for damages and injuries exceeding those which occurred:

1. Sun-Canadian was not fully prepared for the possibility of an emergency situation. Emergency equipment such as fire extinguishers and gas detectors, and safety equipment such as fire retardant clothing, spark arrestors and wind direction indicators, were not in use or available at the excavation site;
2. From the evidence, it appears that safety precautions were not taken, prior to the commencement of the excavation, to re-route local traffic and notify residents in the immediate vicinity of the work; and
3. The pipeline was filled with butane at the time of excavation. During the course of this project, it was to have been shut down and drained to facilitate the removal of the existing pipe section, however, this was not done prior to excavation of the pipe.

Remedial Measures Underway

As a result of the accident on 27 October 1986, Sun-Canadian has implemented the following measures in an effort to prevent a recurrence of such an accident and to minimize injury and damage should an accident nevertheless occur. The Board endorses these measures.

1. All construction information concerning crossings on the Sun pipeline system will be transferred from files to a master plan. This will also involve reviewing files from the parent company in the U.S.
2. A study is continuing in conjunction with other companies operating HVP pipelines in the Sarnia area concerning HVP emergency response guidelines.

3. A safety check list is being developed for use by inspectors in reviewing jobs with the contractors prior to the commencement of work.
4. The Sarnia Fire Department will be notified prior to work beginning on Sun's pipelines in the Sarnia area.
5. Cellular telephones will be installed in company vehicles. A similar telephone will be available at the Sarnia pump station for use by field personnel.
6. A wind sock will be permanently installed at the Sarnia pump station and portable wind socks will be available for use on all jobs such as the one which resulted in the subject accident. A policy will be developed for the use of these wind socks.
7. Fire retardant coveralls will be available for employees performing field work on HVP pipelines.
8. The Maintenance Manual will be revised to cover and emphasize:
 - i) the inspector's responsibility for ensuring a safe excavation;
 - ii) the *minimum* clearance of 30 cm between powered excavation equipment and the pipeline; and
 - iii) additional inspector responsibilities for ensuring that the proper people, as per the contract or sub-contract, are on site, and for assessing the qualifications of those who will do the work.
9. The relevant safety-related sections from the Maintenance Manual will be included in construction contracts.
10. A form will be prepared and used at the job site requiring written acknowledgement that, before the job proceeds, the company's safety requirements are fully understood by the operator and foreman or supervisor on site.
11. Sun-Canadian manuals will be reviewed and revised to be consistent with Sun requirements.

Additional Steps Required

Further to the measures already undertaken by Sun and Sun-Canadian, the Board is of the view that Sun should ensure that the following additional steps be taken in order to promote the safer operation of its pipeline in Canada:

1. Sun-Canadian should have references in its Maintenance Manual regarding the safety precautions to be followed when work is being done in the vicinity of HVP pipelines;
2. Sun-Canadian should include in the section of its Maintenance Manual on Inspector Responsibilities the options available to an inspector should he not be satisfied with the qualifications of the people on site or the quality of the work as it proceeds. Inspector responsibilities should also include the requirement to promptly record all construction and crossing information and to report this information to the appropriate company department for recording on the master pipeline drawing;
3. Sun-Canadian should include in its contracts for work on the pipeline a clause establishing supervisory responsibilities;
4. Sun-Canadian should ensure that all contractors and sub-contractors authorized to be on the work site are provided with appropriate safety information several days prior to the commencement of the work and that safe work permits or checklists are used as a reminder of this information;
5. Sun-Canadian, in conjunction with Sun, should investigate the possibility of adopting a practice of displacing HVP products with LVP products at any work site before excavation proceeds;
6. Sun-Canadian should investigate the adoption of a practice of diverting traffic in the vicinity of any construction and excavation work as well as advising nearby residents of the nature of the work;
7. During excavation, Sun-Canadian should require an inspector to be in constant attendance when powered excavating equipment is operating; and

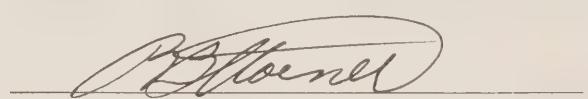
8. Sun-Canadian should provide the Board with updated sections of its Maintenance Manual, a pro forma copy of the safe work permit, and a report on the results of the study on HVP pipeline emergency response guidelines.

Applicable Regulations

The accident occurred despite the existence of the Board's Oil Pipeline Regulations and the standards issued by the Canadian Standards Association. A review of the likely contributory factors indicates that, while a number of things should have been done differently and better, no specific breach of regulations can be pointed to as the clear-cut cause of the accident.

Any concerns that the Board might have had resulting from this accident as to the sufficiency of its Regulations have been addressed in the draft Onshore Pipeline Regulations;* no further changes are required.

The foregoing constitutes the findings and recommendations of the Board in the matter of the National Energy Board inquiry into the Sun pipeline accident on 27 October 1986 at Sarnia, Ontario.



R.B. Horner, Q.C.
Presiding Member



R.F. Brooks
Member



A.B. Gilmour
Member

Ottawa, Canada
March 1987

*The new Onshore Pipeline Regulations will replace the existing Oil Pipeline Regulations and Gas Pipeline Regulations.

Appendix A

Detailed Description of the Accident and Related Events

Events prior to 27 October 1986

Sun Pipe Line Company, a company incorporated pursuant to the laws of the United States of America, owns and operates interstate pipeline systems throughout the U.S. Sun's eastern region includes a length of 3.5 km of 219.1 mm diameter pipeline which runs south and west from Sun-Canadian's Sarnia pump station to the international boundary in the St. Clair River where it joins the balance of the U.S. system and terminates at Toledo, Ohio. By agreement between Sun-Canadian and Sun, Sun-Canadian has operated and maintained this short segment of pipeline since 1953.

In July 1986, Sun-Canadian signed a contract with Sun to relocate and automate the mainline block valve on this line on the Canadian side of the St. Clair River. By Order No. XOM-11-86, issued on 25 June 1986, the Board exempted the new facilities from certain sections of the NEB Act provided that, prior to completion of the modifications, Sun submit its pressure testing procedure to the Board for approval and the work be completed on or before 31 December 1987. Completion of the work was scheduled for late October 1986.

Kel-Gor was awarded the contract. On 23 September 1986, Mr. John Lynch, Sun-Canadian's project coordinator for the valve relocation work, met with Mr. Ian O'Hagan, construction supervisor for Kel-Gor, to sign the contract and discuss various aspects of the project including the hazardous nature of the HVP product in the line. On 17 October 1986, a meeting was held at Sun-Canadian's offices in Waterdown, Ontario. The meeting was attended by several Sun-Canadian employees associated with the valve work including Mr. John Thompson who was to be Sun-Canadian's inspector on the project. The purpose of the meeting was to acquaint Mr. Thompson with the work to be undertaken.

On 21 October 1986, Kel-Gor started prefabrication of the valve and pipe assembly at its yard in Sarnia with Mr. Thompson in attendance. According to Kel-Gor's construction schedule, excavation of the existing valve and pipe facility was to begin on Monday, 27 October 1986. Mr. Thompson left Sarnia on 23 October 1986. Prior to leaving, he made arrangements to have Mr. Lee Schultz act on

his behalf as the inspector for the excavation work. Mr. Schultz is a senior operator with Sun-Canadian in Sarnia and is qualified, according to Sun-Canadian, to inspect construction work. Mr. Schultz was advised that he would be responsible for contacting the various utility companies to ensure that their lines were located prior to the excavation.

Without Sun-Canadian's consent, which was required by the terms of the contract between Sun-Canadian and Kel-Gor, Kel-Gor sub-contracted parts of the contract to another contractor, Dixxin. This was done shortly after Kel-Gor had been awarded the contract. Kel-Gor provided Dixxin with a set of construction drawings and specifications for the work and told Dixxin they would be advised by Kel-Gor when to commence the excavation. The contract between Kel-Gor and Dixxin was a verbal one.

On 24 October 1986, Mr. O'Hagan contacted Mr. Domenic Iacovella, the owner of Dixxin, and arranged to meet him at the work site to discuss the project. Mr. Iacovella was informed that the excavation work had to begin Monday, 27 October 1986. At the time of this meeting, all of Dixxin's manpower and excavation equipment were in use on other projects. Mr. Iacovella did not inform Mr. O'Hagan of this fact. He did inform him that Dixxin would be leasing a backhoe from Capex for the job. Following this meeting, Mr. Iacovella contacted Mr. Mario DiCocco, president of Mar-D and arranged to meet him at Dixxin's offices. Mar-D had previously agreed to assist Dixxin with this job if required. The two men then visited the site of the work. Mr. DiCocco was provided with two drawings of the proposed work by Mr. Iacovella and was asked to provide the necessary manpower to perform the job. Mr. DiCocco would be the foreman, and there would be a backhoe operator and a labourer. Again, no written contract was signed by these parties.

Events on 27 October 1986

At approximately 0800 hours EDT on 27 October 1986, Messrs. Ronaldo DiCocco, Aldo Rocco and Mario DiCocco, all of Mar-D, arrived at the Sun-Canadian valve relocation site immediately to the east of the St. Clair Parkway. Mr. R. DiCocco was to operate the backhoe for the excavation, Mr. Rocco was to be the labourer, and Mr. M. DiCocco was to be the foreman, on behalf of Dixxin.

Shortly after 0800 hours EDT, the backhoe from Capex arrived by float and Mr. R. DiCocco parked it near the excavation site. Excavation did not begin at this time since a representative from Sun-Canadian had not yet arrived, the Bell and Union Gas lines in the area had to be located and Mr. DiCocco was expecting a supervisor from Kel-Gor.

At approximately 0830 hours EDT, Mr. M. DiCocco left the site for his office and told Messrs. R. DiCocco and Rocco not to begin work until he returned.

Mr. Lee Schultz, the inspector for Sun-Canadian, arrived at approximately 0900 hours EDT. He was unaware of the requirement in the contract between Sun-Canadian and Kel-Gor that Sun-Canadian's consent was required for sub-contracting arrangements. At this point, there are differences in the evidence as to what information concerning the excavation and hazards of the job was relayed by Mr. Schultz to Messrs. R. DiCocco and Rocco. Mr. Schultz stated that he mentioned the contents and pressure of the line as well as the extent to which the backhoe could be used for excavating purposes. Neither Mr. R. DiCocco nor Mr. Rocco recalls having received this information.

Mr. Tom Smith, representing Bell, and a representative from Union Gas Limited arrived at the site at approximately 0930 hours EDT to locate their lines. Mr. Ian O'Hagan, the construction supervisor for Kel-Gor, also came to the job site prior to the commencement of the excavation. He explained to Mr. Schultz that Mar-D, rather than Kel-Gor, would be doing the excavation. He discussed with Mr. Schultz the surveying and elevation shots that had to be done and requested that Mr. John Thompson, the inspector from Sun-Canadian who was to arrive on site later that morning to assume the inspection duties, call him when more digging had been completed. Mr. O'Hagan testified that as he was leaving the site, after having been there approximately five to ten minutes, he mentioned to Messrs. Schultz, R. DiCocco and Rocco the requirement for hand-digging the line. Messrs. R. DiCocco and Rocco do not recall this conversation.

Mr. M. DiCocco returned shortly after Mr. O'Hagan had left. At this point, the Union Gas representative had completed locating his company's services and Mr. Smith had indicated that, since the Bell cable was west of the valve, excavation to the east could commence. Mr.

Schultz reviewed one of the contract drawings with Mr. M. DiCocco. After looking down the valve stem cannister and concluding that the depth of the line was about three feet, Mr. Schultz told Mr. M. DiCocco that approximately two feet of soil could be removed by backhoe, one foot at a time, and that probing would be done after each cut. Mr. M. DiCocco cannot recall whether or not he was informed of the hazards of the pipeline whereas Mr. Schultz recalls giving him the same information as he gave to Messrs. R. DiCocco and Rocco. Just prior to beginning the excavation, the backhoe was used to remove six metal posts which had formed a protective barrier around the valve shutoff.

Mr. R. DiCocco then positioned the backhoe with a track on either side of the line and began to excavate a trench over the line one bucket wide, approximately eight to ten feet in length. Each cut was one foot deep. Mr. Schultz used the probing bar after each cut. Following the second cut, when Mr. Schultz had hit something hard with the probe bar, Messrs. M. DiCocco and Rocco hand excavated at that location and exposed the insulating flange box and the eastern-most bond cable shown in Appendix D.

At this point, the evidence is unclear as to which of two fittings, a coupling welded cap or a Hillco tapping nipple, was located and marked. Messrs. DiCocco and Rocco stated that the coupling welded cap was hand-exposed at the same time as the insulating joint and marked with a shovel. A trench was dug on either side of the pipe, the backhoe was moved further east eight to ten feet and trenching was again begun over the pipe. Messrs. DiCocco and Rocco testified that no other fittings were uncovered.

Mr. Schultz stated that, following the hand-exposure of the insulating flange box, the backhoe was moved approximately ten feet further east to continue excavation over the pipe. Probing after these cuts located the pipe near the end of this trench. Hand-digging at that location exposed the Hillco fitting which was marked with a shovel. Mr. Schultz testified that the coupling welded cap had not been exposed. After the backhoe had been moved, Mr. Schultz gave instructions to Mr. M. DiCocco to widen the trench to the south of the line. Mr. Smith had finished locating the Bell cable to the west of the valve cannister and motioned to Mr. Schultz that he wished to discuss the location with him. Mr. Schultz left the trench to talk to Mr. Smith

who was standing near his van at the roadway, some eight to nine metres southwest of the backhoe. Mr. R. DiCocco had begun to use the backhoe to remove excess dirt between the flange and the Hillco fitting.

Messrs. Schultz and Smith had been discussing the location of the telephone lines for approximately 30 seconds when, at 1001 hours EDT, the bucket of the backhoe hit the Hillco fitting approximately 18.2 cm above the top of the pipe, causing a release of butane. Messrs. M. DiCocco and Rocco were thrown from the ditch and made their way to the St. Clair Parkway. They were picked up by a passing motorist and driven to the Shell Emergency Unit, approximately 600 m south of the accident site.

Mr. Schultz instructed Mr. Smith to go south along the St. Clair Parkway and begin stopping traffic while he proceeded towards the backhoe. He instructed Mr. R. DiCocco to shut down the machine and proceed south and stop traffic. Mr. R. DiCocco made his way to the St. Clair Parkway where, since he had become ill due to vapour inhalation, he was taken to the Shell Emergency Unit.

Mr. Schultz then ran south along the St. Clair Parkway and entered a private residence and evacuated the occupants. He then proceeded north to the residence adjacent to the leak site and informed the occupants to leave the site. While they were preparing to do so, Mr. Schultz left the house and proceeded to the front yard. At this time, the butane cloud accidentally ignited, burning Mr. Schultz.

After the ignition, Mr. Schultz accompanied the occupants of the house to the south of the site and was transported to Sarnia General Hospital by a motorist who was at the roadblock.

Emergency Response of Sun-Canadian

The Sarnia pump station is located approximately 3 219 m upstream and to the northeast of the accident site. At 1006 hours EDT the pump station operator noticed a decrease in line pressure on the 219 mm Sun pipeline. The isolation valve, located at the pump station, was closed immediately. Inquiries were then made at the Company's Inkster, Michigan station to determine if operations there had caused the reduction in pressure.

At 1020 hours EDT, Sun-Canadian was advised by phone that a fire had occurred at the excavation site on the St. Clair Parkway. The Sun control centre at Wayne, Indiana, was then contacted and requested to close the mainline valve located some 708 m west of the accident site, on the U.S. side of the St. Clair River. The valve was closed immediately.

At 1025 hours EDT, the Suncor Inc. refinery control room was notified and fire-fighting equipment was dispatched.

Emergency Response of Other Agencies

The Chemical Valley Emergency Control Organization (CVECO) was notified at 1011 hours EDT and initiated its emergency plan.

Fire-fighting assistance was provided by Shell and Suncor refineries and the Sarnia, Courttright and Corunna fire departments. A command post and communications centre was established at the site by the CVECO. The Sombra Detachment of the Ontario Provincial Police provided traffic control at the scene and evacuated five residences in the surrounding area.

Control and Extinguishing of Fire

With the pipeline isolation valve at the Sarnia pump station and the mainline valve on the U.S. side of the river closed, the fire was brought under control and the amount of product available to the fire was limited to that contained in 3 927 m of 219 mm O.D. line, approximately 140 m³. The fire was kept burning under "drain down" conditions to dispose of the escaping product. Control of this operation was maintained by fire-fighting crews.

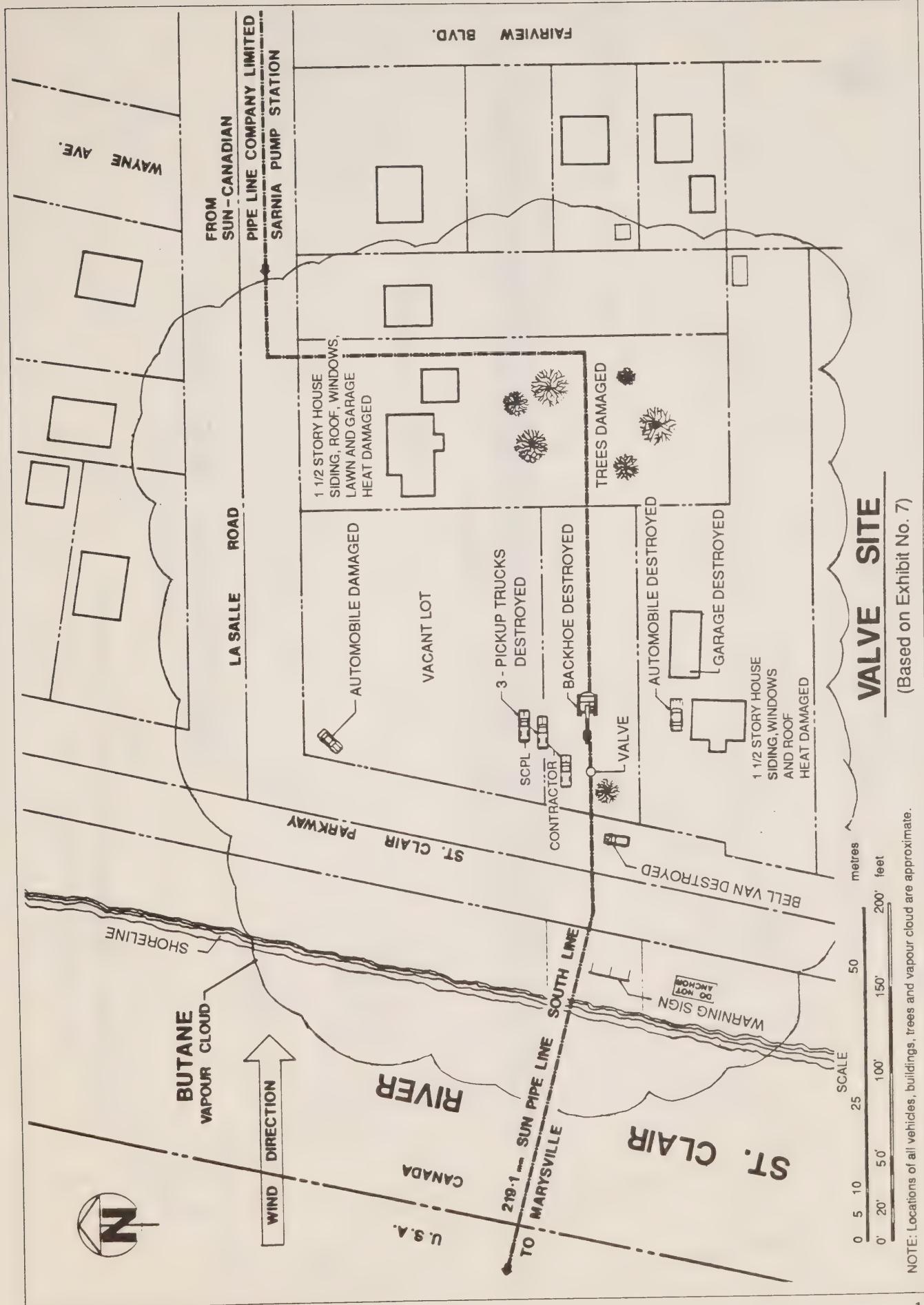
On Wednesday, 29 October 1986 Sun-Canadian began injecting a batch of water at the Sarnia pump station. By 1245 hours EDT the water batch had displaced the remaining butane between the Sarnia pump station and the mainline valve adjacent to the incident site. At this point the fire was extinguished, and the mainline valve was closed.

A PLIDCO repair sleeve was bolted to the pipeline at the location of the damaged Hillco tap. The mainline valve adjacent to the incident site was opened and the water batch was pumped through to

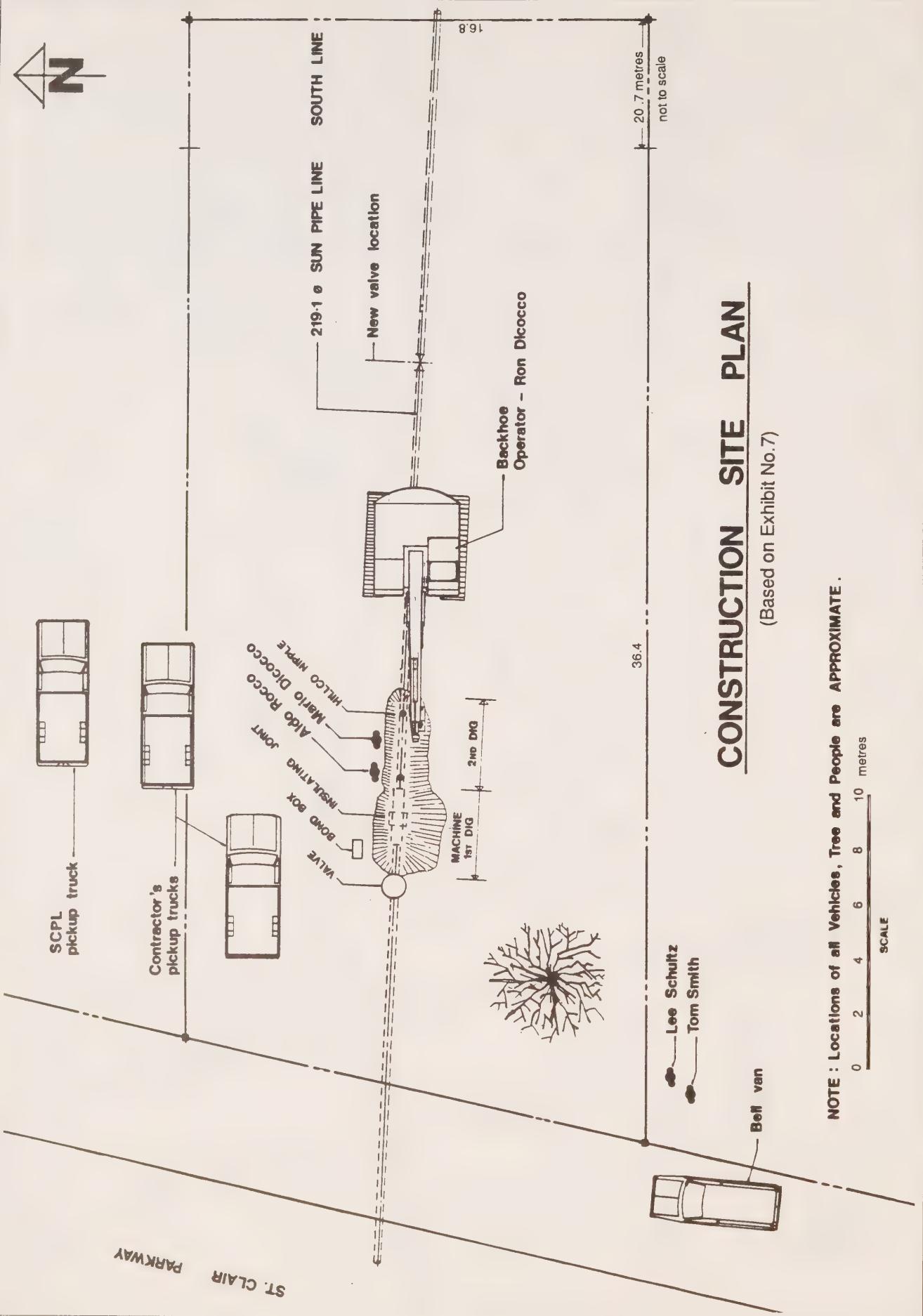
the mainline valve at the U.S. side of the St. Clair River. At this point the entire Sun pipeline section between the Sarnia pump station and the U.S. mainline valve, some 3 927 m, was filled with water.

By 1600 hours EDT on 29 October 1986, the damaged backhoe had been removed from the site and work was begun to complete the project of removal and replacement of the mainline valve.

The project was completed on 31 October 1986 and the pipeline was returned to normal operation at 2400 hours EDT, 31 October 1986.



Appendix C



PIPE SECTION

(Based on Exhibit No. 7)

